

## Social Dialogue for the Future of Manufacturing



# What is Industry 4.0

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**Industry 4.0** is the term used for the first time in the *Recommendations for Implementing the strategic initiative INDUSTRIE 4.0* drawn up in April 2013 by **Forschungsunion and Acaech** with the support of the German Ministry of Education and Research

## **Production system featuring the following technologies :**

**big data**

**addictive manufacturing**

**robotics**

**internet of things e cyber phisics systems**

**cloud**

**Augmented reality**

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# Impacts on production systems

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- Automation of production
  - Labour digitization
  - Product customization
  - Production flexibility
  - Greater efficiency and higher productivity  
Extension of the production chain
  - Replicability of the products
-

# Change the role of worker. Two possible scenarios:

## Qualification requirements for Industry 4.0

### Automation scenario

- **Monitoring and control technology**
- **CPS directs employee (primarily performing actively)**
- **Highly qualified personnel for installation, modification and maintenance of the CPS**

#### Labourers

Mid-level employees:



Specialised employees:



Highly qualified:



### Specialisation scenario

- **CPS support decisions**
- **Employee directs CPS**
- **Skilled personnel retain dominant role**
- **More informational, organisational, mechatronic content**

#### Labourers

Mid-level employees:



Specialised employees:

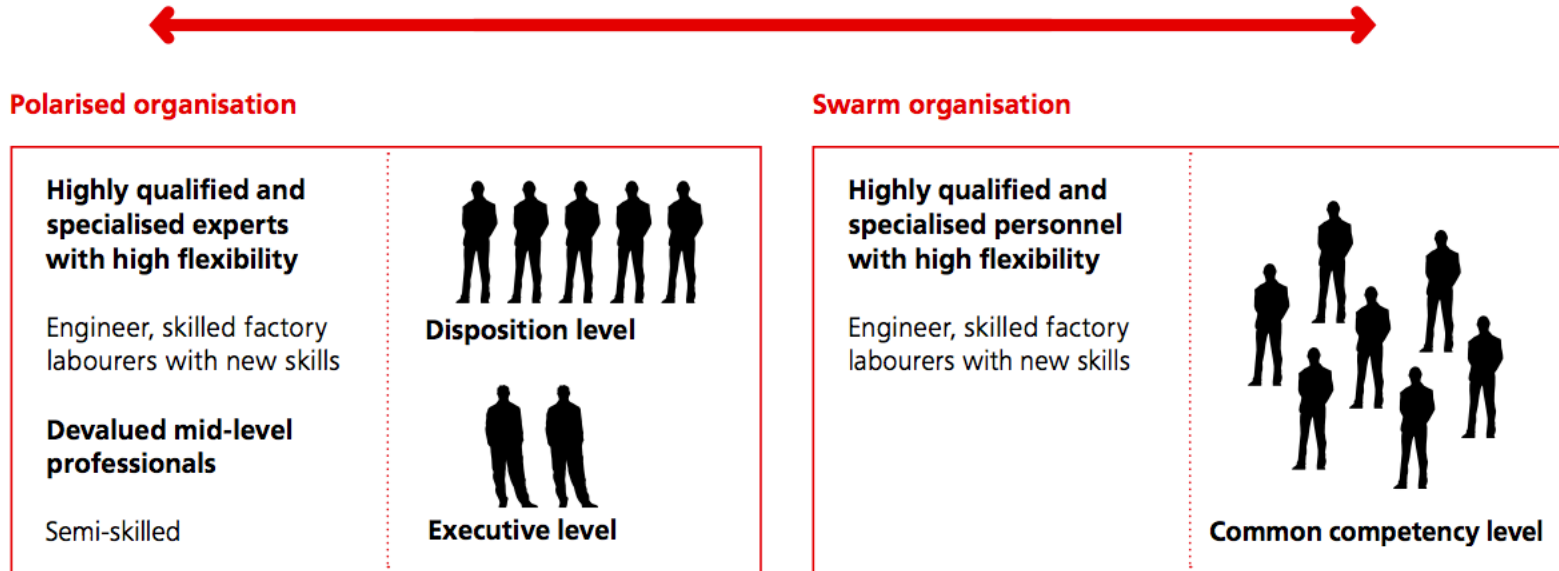


Highly qualified:



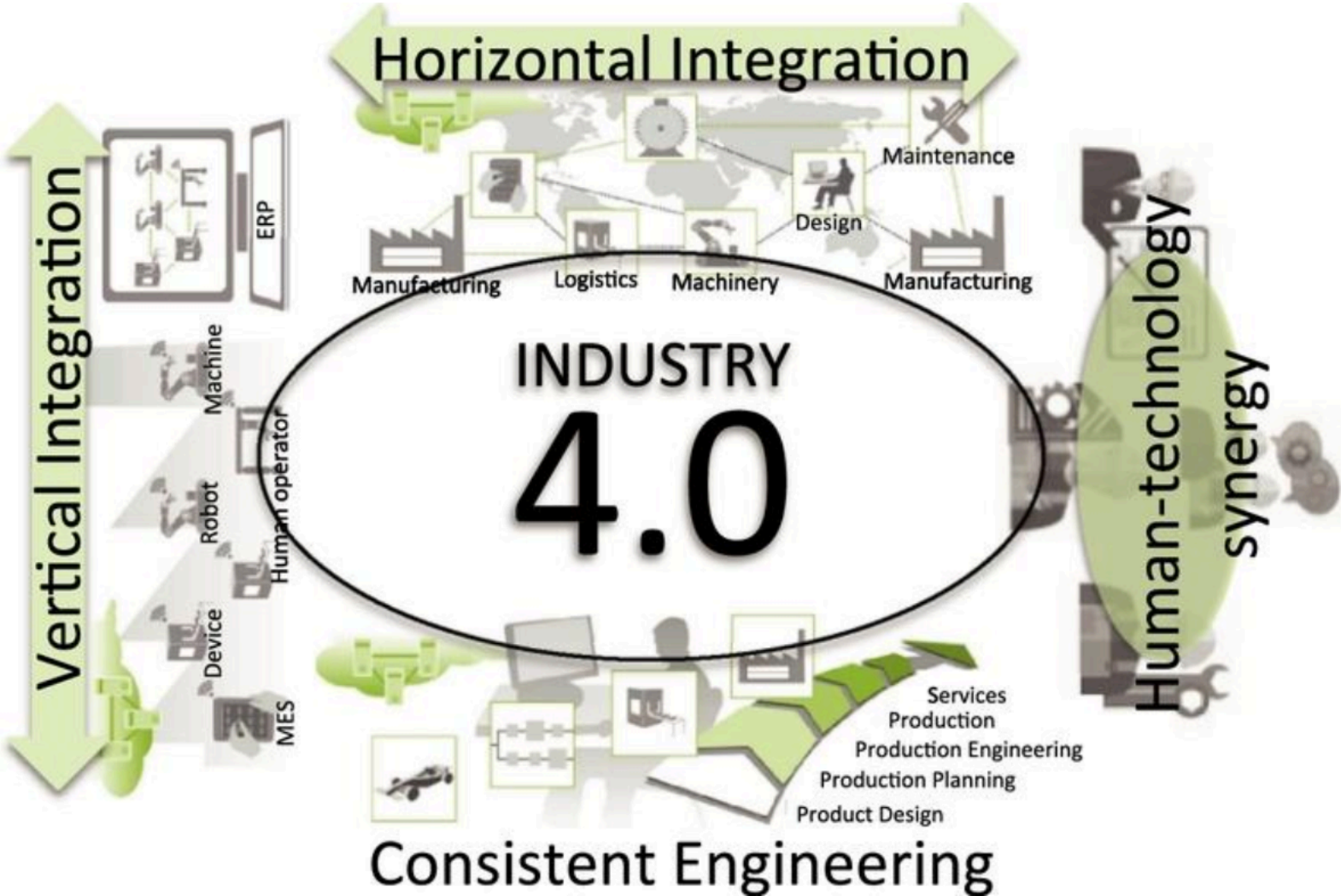
# Change work organization. Two possible scenarios:

Figure 3  
Polarised versus swarm organisation



Source: Hirsch-Kreinsen 2014: 4.

# A new orientation



# The key points

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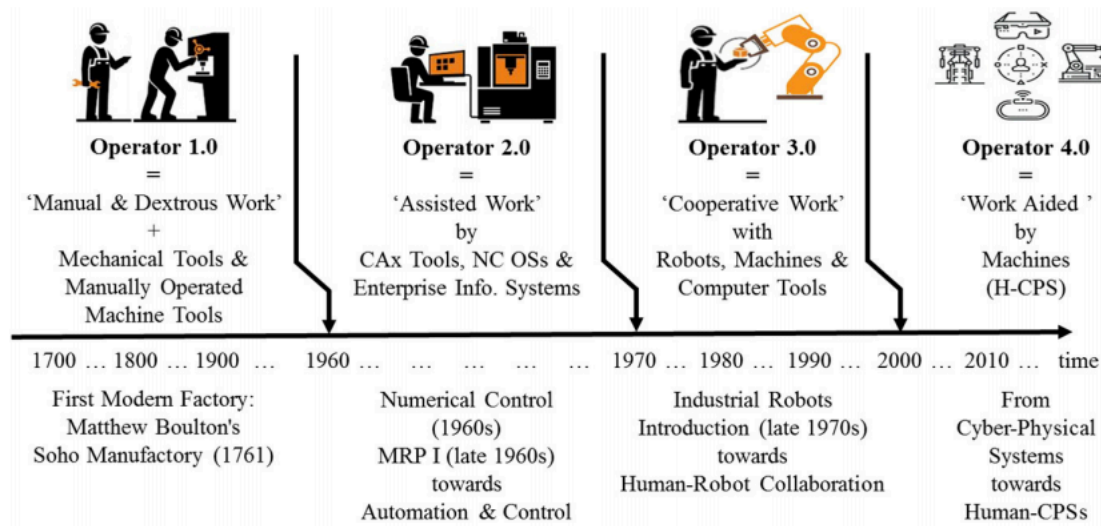
- Team and collaboration
  - Space-time autonomy  
(*smartworking*)
  - Employee sharing
  - Less tasks more roles
  - New mix of skills
-



# The new operator 4.0

*A smart and skilled operator who performs not only – “cooperative work” with robots – but also – “work aided” by machines as and if needed – by means of human cyber-physical systems, advanced human-machine interaction technologies and adaptive automation towards “human-automation symbiosis work systems”*

(Romero et al., 2016)





# The new operator 4.0

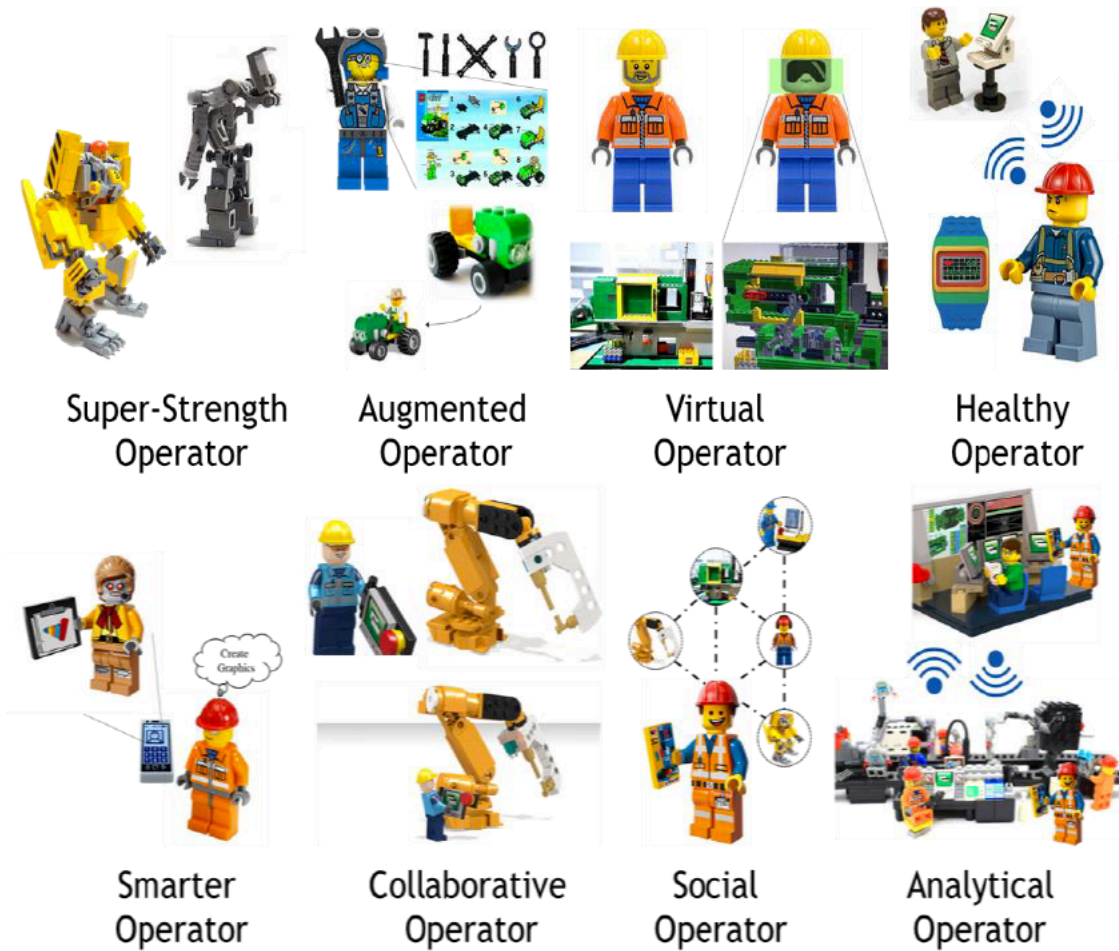


Figure 1: Operator 4.0 Typology

# Role of skills

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## Two issues:

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graph TD; A["Two issues:"] --> B["New figures:  
Cloud Broker, Network Programmer, Data Scientist, Robot teacher ecc.  
  
Mission of any company is to identify the specific figures necessary and participate in their training"]; A --> C["Soft skills  
•Need for cross communication skills, autonomy, organization of their work.  
•Ability to manage a complex scenario and skills"];
```

### **New figures:**

*Cloud Broker, Network Programmer, Data Scientist, Robot teacher ecc.*

Mission of any company is to identify the specific figures necessary and participate in their training

### **Soft skills**

- Need for cross communication skills, autonomy, organization of their work.
- Ability to manage a complex scenario and skills

# The Jobs Landscape in 2022

emerging  
roles,  
global  
change  
by 2022

133  
Million

## Top 10 Emerging

1. Data Analysts and Scientists
2. AI and Machine Learning Specialists
3. General and Operations Managers
4. Software and Applications Developers and Analysts
5. Sales and Marketing Professionals
6. Big Data Specialists
7. Digital Transformation Specialists
8. New Technology Specialists
9. Organisational Development Specialists
10. Information Technology Services

declining  
roles,  
global  
change  
by 2022

75  
Million

## Top 10 Declining

1. Data Entry Clerks
2. Accounting, Bookkeeping and Payroll Clerks
3. Administrative and Executive Secretaries
4. Assembly and Factory Workers
5. Client Information and Customer Service Workers
6. Business Services and Administration Managers
7. Accountants and Auditors
8. Material-Recording and Stock-Keeping Clerks
9. General and Operations Managers
10. Postal Service Clerks

## 2022 Skills Outlook

### Growing

- 1 Analytical thinking and innovation
- 2 Active learning and learning strategies
- 3 Creativity, originality and initiative
- 4 Technology design and programming
- 5 Critical thinking and analysis
- 6 Complex problem-solving
- 7 Leadership and social influence
- 8 Emotional intelligence
- 9 Reasoning, problem-solving and ideation
- 10 Systems analysis and evaluation

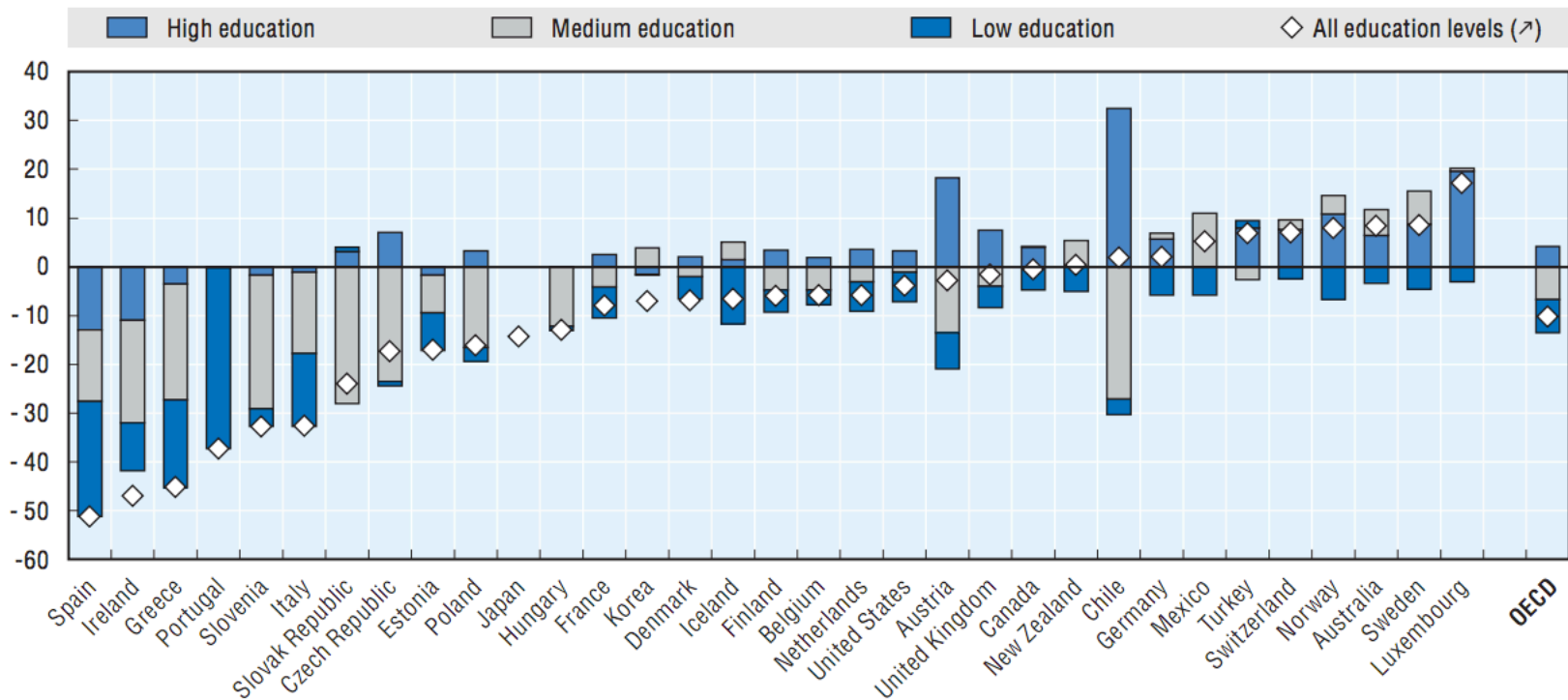
### Declining

- 1 Manual dexterity, endurance and precision
- 2 Memory, verbal, auditory and spatial abilities
- 3 Management of financial, material resources
- 4 Technology installation and maintenance
- 5 Reading, writing, math and active listening
- 6 Management of personnel
- 7 Quality control and safety awareness
- 8 Coordination and time management
- 9 Visual, auditory and speech abilities
- 10 Technology use, monitoring and control

# Why skills in a changing world of work?

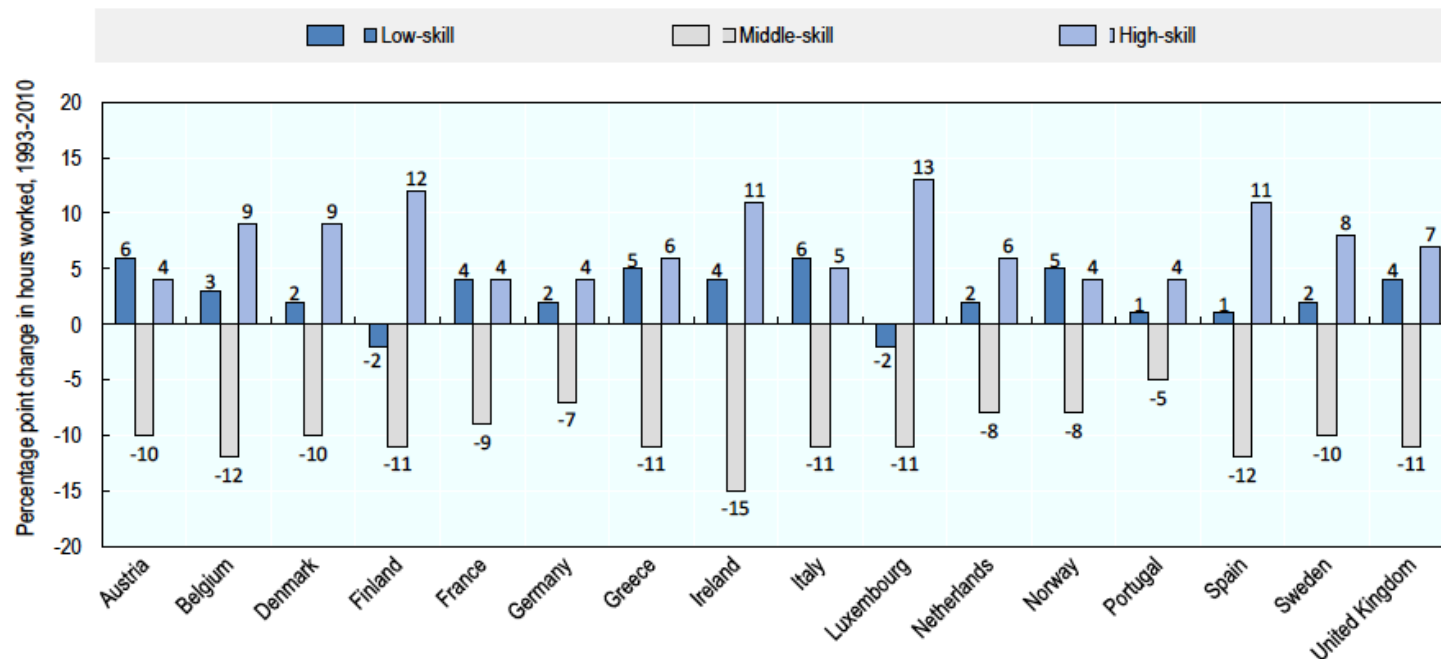
Figure 1.3. **Poorly educated young people were hit hardest by the recession**

Percentage change in numbers of employed 15-to-29 year-olds, between 2007 and 2014, by level of education



# Why skills in a changing world of work?

Figure 3. Labour market polarisation in selected OECD countries, 1993-2010



Notes: This figure shows percentage point changes in hours worked in low-, mid- and high-skill occupations in 16 OECD countries between 1993 and 2010.

Source: Goos et al. (2014).

Figure 3: Optimized viable and desirable job transitions across job families by 2026

Starting job family	Target job family																				Viable job transition options found	Gross job destruction by 2026	Disrupted jobs without viable transition options
	Architecture and Engineering	Arts, Design, Entertainment, Sports and Media	Building and Grounds Cleaning and Maintenance	Business and Financial Operations	Community and Social Service	Computer and Mathematical	Construction and Extraction	Education, Training, and Library	Farming, Fishing, and Forestry	Food Preparation and Serving	Healthcare Practitioners and Technical	Installation, Maintenance and Repair	Life, Physical, and Social Science	Office and Administrative	Personal Care and Service	Production	Protective Service	Sales and Related	Transportation				
Architecture and Engineering																					N/A	0.0	0.0
Arts, Design, Entertainment, Sports, and Media	0.1	11.9		0.1	0.1			0.1	4.5	1.4			1.0		0.9		0.9				21.0	-26.2	8.2
Building and Grounds Cleaning and Maintenance																					N/A	0.0	0.0
Business and Financial Operations				36.9																	36.9	-47.8	10.9
Community and Social Service																					0.0	-3.0	3.0
Computer and Mathematical						22.6															22.6	-22.6	0.0
Construction and Extraction	0.4	0.2					0.3					0.1						0.1	0.1		1.2	-1.2	0.0
Education, Training, and Library								3.9													3.9	-3.9	0.0
Farming, Fishing, and Forestry			1.0				3.5		0.1								9.2				13.8	-14.2	0.4
Food Preparation and Serving										30.2	3.1										33.3	-33.3	0.0
Healthcare Practitioners and Technical								1.7			6.1										7.8	-9.8	2.0
Installation, Maintenance, and Repair	2.9	1.4	4.5			0.9	0.6		0.0			13.7	1.4								25.4	-28.9	3.5
Life, Physical, and Social Science																					N/A	0.0	0.0
Office and Administrative	0.0	5.0		221.1	2.5	11.8	20.9	8.2	8.8	30.5	13.0	2.0	236.1	7.6	0.4	5.7	40.4	8.0			621.8	-642.0	20.2
Personal Care and Service		0.4		0.2																0.6	-0.6	0.0	
Production	13.2	0.9	11.0	1.1		5.1	298.6	0.4	27.1	3.0	2.1	60.9	10.5	20.2	5.2	6.7	0.6	2.0	21.4		489.9	-510.7	20.8
Protective Service				0.3									2.4	0.7			34.8		3.5		41.7	-41.7	0.0
Sales and Related				4.7		0.6				29.5					2.7		0.5	3.2			41.2	-41.3	0.1
Transportation	0.2						0.2			5.5		1.5					0.4		0.6		8.4	-8.4	1.0
Optimal number of transitions to job family by 2026	16.7	19.8	16.5	264.4	2.6	41.0	324.1	14.3	40.5	100.1	24.3	80.6	13.6	256.3	16.4	7.1	52.2	45.6	33.5	1,369.4	-1,438.6	67.2	
Gross job creation by 2026	197.2	172.3	489.6	1,333.9	348.1	860.2	799.9	793.3	81.4	1,285.5	2,339.3	411.4	124.8	751.3	1,164.9	142.4	196.6	478.9	649.7	12,415.7			

Source data: Burning Glass Technologies and US Bureau of Labor Statistics.

Note: Units = 1,000s of people.



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**What to do and how**

**Some ideas...**

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# Socio-technical enablers

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- Skills
  - Work organization
  - Industrial relations
  - Welfare
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# Institutional enablers

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- Infrastructures (digital and physical)
  - Fiscal incentives
  - Labour market actors (i.e. ALMPs)
  - Universities and research centers
  - Professional schools
  - Industrial relations actors (local and national)
  - Political reforms
  - Company networks
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**Socio-technical + Institutional enablers**

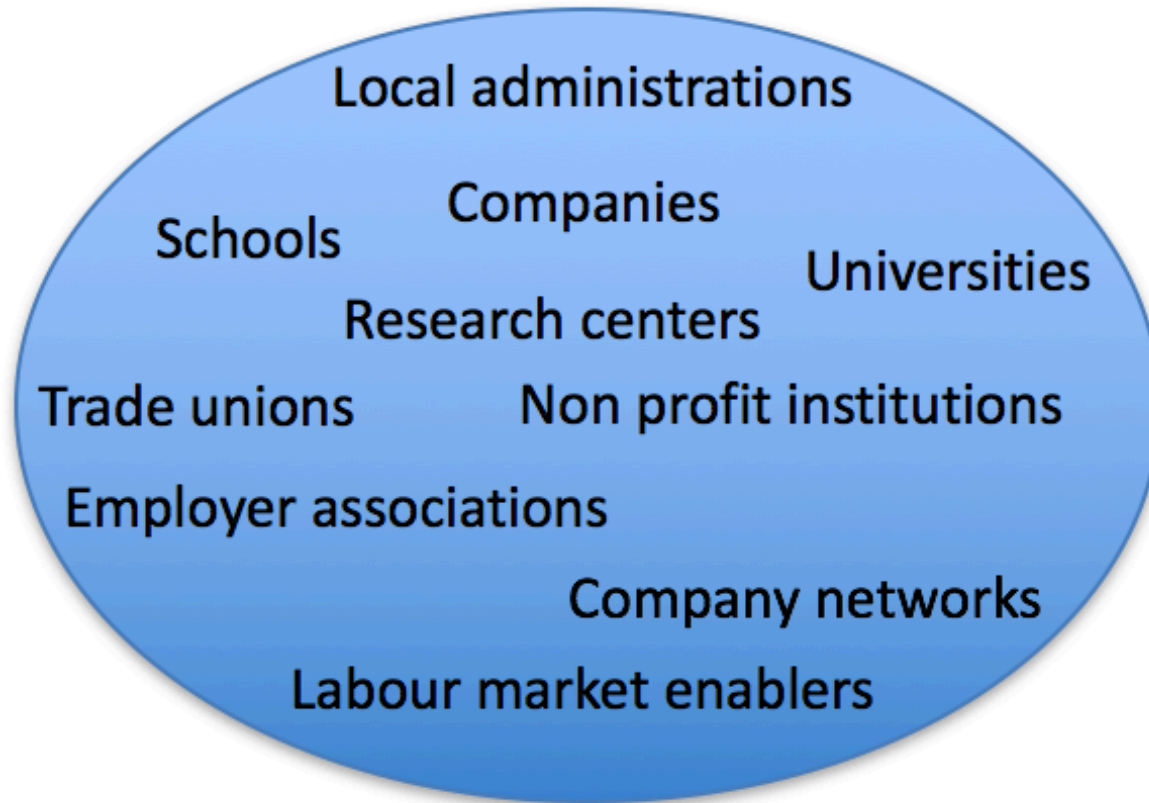
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**Ecosystem 4.0**

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# Which actors?

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# How?

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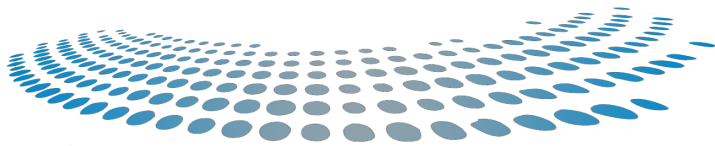
- VET
  - Collective agreements
  - Reskilling strategies
  - On the job training
  - Skill assessments
  - Active ageing
  - Apprenticeships
  - Industrial doctorates
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EUROPEAN COMMISSION

# SODIMA

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*Thank you  
for your  
attention!*